TRANSACTIONS
AMERICAN
GEOPHYSICAL UNION

A QUARTERLY JOURNAL DEVOTED TO
MATTERS OF GENERAL INTEREST IN
THE BROAD FIELD OF GEOPHYSICS

Volume 45
1964

Published by the American Geophysical Union
of the
National Academy of Sciences
National Research Council
Washington, D. C.
1964

Transactions, American Geophysical Union, Vol. 45, No. 1, March 1964

CONTENTS

President's Page ..... Thomas F. Malone 1

PROGRAM OF THE FORTY-FIFTH ANNUAL MEETING

Table of Contents 3
Map of Meeting Places 4
Schedule of Sessions 5
Notes 6
Program 9
Schedules and Abstracts 29
General Assembly of the Union 29
Section of Geodesy 30
Section of Geomagnetism and Aeronomy 36
Section of Hydrology 50
Section of Meteorology 55
Section of Oceanography 65
Section of Planetary Sciences 74
Section of Seismology 91
Section of Tectonophysics 100
Section of Volcanology, Geochemistry, and Petrology 108
Geophysics Symposium 129
AGU–AAS–URSI Symposium 129
NAS–NRC Division of Earth Sciences 130
Author Index 131

ARTICLES

Decisions Taken at the ICSU Executive Board and General Assembly Meetings of Special Interest to IUGG ..... George D. Garland 137
International Symposium on the Dynamics of Large-Scale Processes in the Atmosphere 141
Ninth National Conference U. S. National Commission for UNESCO 149
Japanese Research in Flow of Fluids through Porous Materials and Filtration ..... R. E. Collins 151
Flip Returns from Mid-Pacific Research Cruise ..... John Northrop 165
Regional Conference of the National Commission on Teacher Education and Professional Standards (NCTEPS) ..... Waldo E. Smith 167

REVIEWS

Gunter Dietrich, General Oceanography ..... F. F. Koczy 169
Elmar R. Reiter, Jet Stream Meteorology ..... J. J. George 169
M. Roche, Hydrologie de Surface ..... V. M. Yevdjevich 170
Ralph Deutsch, Orbital Dynamics of Space Vehicles ..... J. M. A. Danby 171
E. Sherbon Hills, Elements of Structural Geology ..... Ernst Cloos 172

PUBLICATIONS AND TRANSLATIONS OF INTEREST TO GEOPHYSICISTS

Recent Publications of Interest to Geophysicists 173
Contents of Bulletin (Izvestiya), Academy of Sciences, USSR, Geophysics Series 175
Contents of Geodesy and Aerophotography, USSR 176
Contents of Oceanography Translations 177
Contents of Soviet Hydrology, Selected Papers 178
Contents of Geomagnetism and Aeronomy, USSR 179
English Translations of Russian and Other Scientific Papers and Journals 181

(*Continued inside back cover*)

CONTENTS

(*Continued from back cover*)

NOTES AND PERSONALIA

Notes ... 185
Personalia ... 188

UNION, SECTION, AND COMMITTEE ACTIVITIES

Minutes of the Council Meeting, AGU, December 27, 1963 ... 191
Appendix 1—Report of the General Secretary, October 18, 1963 ... 193
Appendix 2—Report of the Editors, Journal of Geophysical Research
Philip H. Abelson and James A. Peoples, Jr. 199
Appendix 3—Hydro-Science: A New Proposed Journal of Water Resources Research
William C. Ackermann 200
Appendix 4—Proposal for a General Bulletin on the Earth and Planetary Sciences
Thomas F. Malone, Hugh Odishaw, and Waldo E. Smith 201
Appendix 5—Report of the Secretary for International Participation ... J. Wallace Joyce 202
Appendix 6—Report of the Committee for the Annual Meeting ... Leroy R. Alldredge 202
Appendix 7—Report of the Committee for the AGU Western National Meeting
J. Kaplan and W. W. Kellogg 203
Appendix 8—Report of the Budget Committee
Louis O. Quam, Howard A. Meyerhoff, and C. F. S. Sharpe 204
Appendix 9—Report of the Committee for the Selection of Fellows ... Hatten S. Yoder, Jr. 212
Report of the Committee of Tellers: Tally of the Triennium Election Ballots ... 213
Third Western National Meeting (1963) ... 215
Tenth Annual Meeting of the Pacific Northwest Region ... 218

SPECIAL ANNOUNCEMENTS

AGU Officers for Next Triennium ... 219
AGU Awards for 1964 ... 219
Advance Registration for 45th Annual Meeting ... 219
Fourth Western National Meeting ... 220
Hydrology Separates Available ... 220
Symposium on Scientific Aspects of Snow and Ice Avalanches ... 220

IG BULLETINS

Bulletin 79 ... 221
Alouette Topside Ionosphere Studies ... 221
Alouette Mid-Latitude Topside Studies ... 227
Preliminary Results of Magnetic-Field Measurements in the Tail of the Geomagnetic Cavity ... 231
Years of the Quiet Sun ... 235
Forthcoming COSPAR Events ... 236
Bibliographic Notes ... 239

Bulletin 80 ... 241
Review of Project Mercury ... 241
Bibliographic Notes ... 259

Bulletin 81 ... 261
Radio Frequency Allocations for Scientific Uses ... 261
Sea-Level Changes Along the Northern Coast of the Gulf of Mexico ... 272
Bibliographic Notes ... 280

Supporting Members ... following page 280

Transactions, American Geophysical Union, Vol. 45, No. 2, June 1964

CONTENTS

Twenty-Sixth Award of the William Bowie Medal, April 21, 1964 281
Citation ..... Scott E. Forbush 281
Presentation ..... Thomas F. Malone 283
Response ..... Mrs. Ilse Bartels 283
Previous Recipients of the William Bowie Medal 284

Third Presentation of the John Adam Fleming Award, April 21, 1964 285
Citation ..... Herbert Friedman 285
Presentation ..... Thomas F. Malone 286
Acceptance and Response ..... Edward O. Hulburt 286
The Principles of the Award 287
Previous Recipients of the John Adam Fleming Award 287

Third Presentation of the James B. Macelwane Award, April 21, 1964 289
Citation ..... W. H. Munk and G. J. F. MacDonald 289
Presentation ..... Thomas F. Malone 290
Acceptance and Response ..... Klaus F. Hasselmann 290
Award Statement 290
Previous Recipients of the James B. Macelwane Award 290

Special Award to J. Wallace Joyce, April 21, 1964 291
Citation ..... Lloyd V. Berkner 291
Presentation ..... Thomas F. Malone 292
Acceptance and Response ..... J. Wallace Joyce 293

ARTICLES

A 'Golden Age' for Geophysics? ..... Thomas F. Malone 295
The Organization of the Environmental Sciences in the Federal Government ..... Robert White 301
A Critique of Current Methods in Hydrologic Systems Investigation ..... J. Amorocho and W. E. Hart 307

REVIEWS

Wynne Thorne (Ed.), Land and Water Use ..... Robert E. Dils 323
R. G. Fleagle and J. A. Businger, An Introduction to Atmospheric Physics ..... J. E. McDonald 323
Ralph W. G. Wyckoff, Crystal Structures ..... Edward C. Jonas 324
K. E. Bullen, An Introduction to the Theory of Seismology ..... D. S. Carder 325

PUBLICATIONS AND TRANSLATIONS OF INTEREST TO GEOPHYSICISTS

Recent Publications of Interest to Geophysicists 326
Contents of Bulletin (Izvestiya), Academy of Sciences, USSR, Geophysics Series 327
Contents of Geomagnetism and Aeronomy, USSR 328
Contents of Soviet Hydrology, Selected Papers 328
English Translations of Russian and Other Scientific Papers and Journals 330

NOTES AND PERSONALIA

Notes 332
Personalia 334

UNION, SECTION, AND COMMITTEE ACTIVITIES

Forty-Fifth Annual Meeting (1964) 337
Joint Session with URSI and AAS 337
Symposium on Recent and Future Trends in Geophysics Education 337
Honors Evening Session 337
General Assembly: Papers on Frontiers in Geophysics, and Business Meeting 338
Smoker 340
Banquet 340
Appendix A—Section of Geodesy 340
Appendix B—Section of Seismology 341
Appendix C—Section of Meteorology 341
Appendix D—Section of Geomagnetism and Aeronomy 342
Appendix E—Section of Oceanography 343
Appendix F—Section of Volcanology, Geochemistry, and Petrology 343
Appendix G—Section of Hydrology 345

Appendix H—Section of Tectonophysics 346
Appendix I—Section of Planetary Sciences 347
Appendix J—Program and Abstracts of the AGU-AAS-URSI Symposium on Solar Terrestrial Relationships, April 20–21, 1964 349
Meeting of the Hydro-Tech Club 356
Pacific Southwest Regional Meeting 356
Abstracts, General Session 356
Section of Hydrology 357
Section of Oceanography 358
Joint AGU-AMS Session—Meteorology and Oceanography 359

SPECIAL ANNOUNCEMENTS

1964 ULF International Symposium 361
Fourth Western National Meeting 361
Southwest Regional Meeting 361
Symposium on Scientific Aspects of Snow and Ice Avalanches 361
Forty-Sixth Annual Meeting 361

IG BULLETINS

Bulletin No. 82 363
Review of Antarctic Geology 363
Current Plans for International Data Exchange 382

Bulletin No. 83 383
Progress of the International Indian Ocean Expedition 383
Movement of the Filchner Ice Shelf, Antarctica 391
Alouette Ionic, Magnetic-Field, and Plasma Studies 398
Bibliographic Notes 402

Supporting Members ..... following page 402

OFFICERS OF THE UNION

Thomas F. Malone, *President*
George P. Woollard, *Vice President*
A. Nelson Sayre, *General Secretary*
J. Wallace Joyce, *Secretary for International Participation*
Waldo E. Smith, *Executive Secretary*

OFFICERS OF THE SECTIONS

Geodesy
Floyd W. Hough, *President*
Charles A. Whitten, *Vice President*
Buford K. Meade, *Secretary*

Seismology
James A. Peoples, Jr., *President*
Jack E. Oliver, *Vice President*
Benjamin F. Howell, Jr., *Secretary*

Meteorology
Morris Neiburger, *President*
Henry G. Houghton, *Vice President*
Woodrow C. Jacobs, *Secretary*

Geomagnetism and Aeronomy
C. T. Elvey, *President*
E. H. Vestine, *Vice President*
J. Hugh Nelson, *Secretary*

Oceanography
Donald W. Pritchard, *President*
Robert S. Arthur, *Vice President*
Arthur E. Maxwell, *Secretary*

Volcanology, Geochemistry, and Petrology
Hatten S. Yoder, Jr., *President*
Edward D. Goldberg, *Vice President*
David R. Wones, *Secretary*

Hydrology
William C. Ackermann, *President*
David K. Todd, *Vice President*
Ralph N. Wilson, *Secretary*

Tectonophysics
Louis B. Slichter, *President*
David T. Griggs, *Vice President*
Iris Borg, *Secretary*

Planetary Sciences
Homer E. Newell, *President*
Robert Jastrow, *Vice President*
A. G. W. Cameron, *Secretary*

Transactions, American Geophysical Union, Vol. 45, No. 3, September, 1964

CONTENTS

President's Page ..... George P. Woollard 403

ARTICLES

The Unity of the Geophysical Sciences ..... Lloyd V. Berkner 405
Recent and Future Trends in Geophysics Education ..... Robert G. Fleagle 409
The International Hydrological Decade ..... Ray Nace 413
Upper Mantle Project ..... Pembroke J. Hart 423
With the Seismologists of the USA ..... E. S. Borisevich 429
World Rift System ..... Charles L. Drake 435
International Heat Flow Committee ..... W. H. K. Lee 441
An IGY/IGC Data Publication with a Built-In Retrieval System ..... Gertrude London 445

REVIEWS

Frances Leigh Williams, Matthew Fontaine Maury, Scientist of the Sea ..... John Lyman 453
Francis P. Shepard, Submarine Geology ..... Gene A. Rusnak 453
N. H. Fletcher, The Physics of Rainclouds ..... Helmut K. Weickmann 454
Hong-Yee Chiu and William F. Hoffmann, Gravitation and Relativity ..... L. I. Schiff 455
Merril Eisenbud, Environmental Radioactivity ..... J. E. McDonald 456

PUBLICATIONS AND TRANSLATIONS OF INTEREST TO GEOPHYSICISTS

Recent Publications of Interest to Geophysicists 456
Contents of Bulletin (Izvestiya), Academy of Sciences, USSR, Geophysics Series 458
Contents of Geodesy and Aerophotography, USSR 459
Contents of Oceanography Translations 460
Contents of Soviet Hydrology, Selected Papers 461
Contents of Geomagnetism and Aeronomy, USSR 462
Contents of Soviet Antarctic Expedition Information Bulletin 463
English Translations of Russian and Other Scientific Papers and Journals 464

NOTES AND PERSONALIA

Notes 466
Personalia 469

UNION, SECTION, AND COMMITTEE ACTIVITIES

Minutes of the Council Meeting, American Geophysical Union, April 21, 1964 472
Appendix 1—Report of the General Secretary, March 6, 1964 ..... A. Nelson Sayre 477
Appendix 2—Report of the Editors, Journal of Geophysical Research ..... Philip H. Abelson and James A. Peoples 483
Appendix 3—Report on the Russian Translation Board ..... Perry Byerly 484
Appendix 4—Report on the Monograph Board ..... Alan H. Shapley 485
Appendix 5—General Report on Publications ..... Waldo E. Smith 485
Appendix 6—Report of the Auditor ..... John C. Burton 487
Appendix 7—Report of the Membership Committee ..... Wilmot N. Hess 491
Appendix 8—Report of the Western National Meeting Committee ..... W. W. Kellogg and J. C. Harrison 491
Appendix 9—Report on International Participation ..... David K. Todd 492
Appendix 10—Report of Tellers Committee ..... James N. Jordan 494
Appendix 11—Report on the Southwestern Region ..... Arthur F. Pillsbury 495
Appendix 12—Report on the Pacific Northwest Region ..... Meredith Thoms 496
Final Report on the Visiting Scientists Program in Oceanography ..... Norris W. Rakestraw 496
Meeting of the Committee on Status and Needs in Hydrology 498

SPECIAL ANNOUNCEMENTS

AGU Announces New Hydrology Journal 499
Fourth Western National Meeting 499
Southwestern Regional Meeting 500
Forty-Sixth Annual Meeting, AGU 500

IG BULLETINS

Bulletin 84 501
Initial Results from the First Interplanetary Monitoring Platform (IMP-I) 501

Bulletin 85 521
International Research in the Antarctic 521
Ariel II—Second US/UK Cooperative Scientific Satellite 527
Solar-Geophysical Activity in 1963 531
Summary of Scientific Satellites and Space Probes Launched in 1963 534
Bibliographic Notes 536

Bulletin 86 537
Review of the West Ford Communications Experiment 537
Cruises 9 and 10 of the US Research Ship *Eltanin* in Antarctic Waters 547
United States—European Space Research Organization Agreement on Scientific Satellites 557
Bibliographic Notes 559

Bulletin 87 561
Rocket Astronomy Studies of the Crab Nebula 561
Upper Mantle Project 565
Cruise No. 11 of the Research Ship *Eltanin* 569
Annals of the International Geophysical Year 574

Supporting Members ..... following page 576

OFFICERS OF THE UNION

GEORGE P. WOOLLARD, *President*
WILLIAM C. ACKERMANN, *Vice President*
A. NELSON SAYRE, *General Secretary*
THOMAS F. MALONE, *Secretary for International Participation*
WALDO E. SMITH, *Executive Secretary*

OFFICERS OF THE SECTIONS

Geodesy
CHARLES A. WHITTEN, *President*
URHO UOTILA, *Vice President*
BUFORD K. MEADE, *Secretary*

Seismology
JACK E. OLIVER, *President*
EUGENE HERRIN, *Vice President*
CARL KISSLINGER, *Secretary*

Meteorology
HENRY G. HOUGHTON, *President*
ROBERT G. FLEAGLE, *Vice President*
WOODROW C. JACOBS, *Secretary*

Geomagnetism and Aeronomy
E. H. VESTINE, *President*
FRANCIS S. JOHNSON, *Vice President*
KENDALL L. SVENDSON, *Secretary*

Oceanography
WAYNE V. BURT, *President*
JOHN A. KNAUSS, *Vice President*
ARTHUR E. MAXWELL, *Secretary*

Volcanology, Geochemistry, and Petrology
JOHN VERHOOGEN, *President*
DONALD E. WHITE, *Vice President*
ROBERT O. FOURNIER, *Secretary*

Hydrology
DAVID K. TODD, *President*
MAX KOHLER, *Vice President*
RALPH N. WILSON, *Secretary*

Tectonophysics
DAVID T. GRIGGS, *President*
WILLIAM F. BRACE, *Vice President*
FRED A. DONATH, *Secretary*

Planetary Sciences
JAMES A. VAN ALLEN, *President*
HERBERT FRIEDMAN, *Vice President*
A. G. W. CAMERON, *Secretary*

Transactions, American Geophysical Union, Vol. 45, No. 4, December 1964

CONTENTS

President's Page; The Answer to a Problem? ..... George P. Woollard

PROGRAM OF THE FOURTH WESTERN NATIONAL MEETING

Table of Contents 577
Notes 578
Table of Sessions 579
Daily Schedule of Sessions 581
Schedules and Abstracts 592
General Assembly of the Union 592
Section of Geodesy 592
Section of Geomagnetism and Aeronomy 594
Section of Hydrology 608
Section of Meteorology 613
Section of Oceanography 620
Section of Planetary Sciences 623
Section of Seismology 633
Section of Tectonophysics 638
Section of Volcanology, Geochemistry, and Petrology 641
Author Index 644

ARTICLES

Further Views on International Cooperation in the Atmospheric Sciences ..... Thomas F. Malone 647
Seismology in the USSR ..... Paul W. Pomeroy 653
Alaskan Earthquake Damages Texas High Plains Water Wells ..... William D. Miller and Donald L. Reddell 659

REVIEWS

H. Craig, S. L. Miller, and G. J. Wasserburg, Isotopic and Cosmic Chemistry ..... A. E. Ringwood 665
Stephen H. Dole, Habitable Planets for Man ..... Carl Sagan 666
W. S. Fyfe, Geochemistry of Solids ..... Charles W. Burnham 666
Donald P. Le Galley and Alan Rosen, Space Physics ..... S. Fred Singer 667
V. A. Magnitskii, Problems of Theoretical Seismology and Physics of the Earth's Interior ..... Daniel Linehan 667
Ivan I. Mueller, Introduction to Satellite Geodesy ..... W. A. Heiskanen 668
E. Thrane, Electron Density Distribution in Ionosphere and Exosphere ..... R. E. Bourdeau 669
V. P. Zenkovich, Scientific Principles of Seashore Evolution ..... O. W. Kabelac 669

PUBLICATIONS AND TRANSLATIONS OF INTEREST TO GEOPHYSICISTS

Recent Publications of Interest to Geophysicists 671
Contents of Bulletin (Izvestiya), Academy of Sciences, USSR, Geophysics Series 673
Contents of Geodesy and Aerophotography, USSR 674
Contents of Oceanography Translations 675
Contents of Soviet Hydrology, Selected Papers 676
Contents of Geomagnetism and Aeronomy, USSR 677
Contents of Soviet Antarctic Expedition Information Bulletin 677
English Translations of Russian and Other Scientific Papers and Journals 680

NOTES AND PERSONALIA

Notes 682
Personalia 686

UNION, SECTION, AND COMMITTEE ACTIVITIES

Union Committees 688
Section Committees 689
A Summary of an Exchange of Views Presented at the Informal Meeting To Discuss the Organization of the Geophysical Sciences 690
Meeting of AGU Committee on Status and Needs in Hydrology ..... Ray K. Linsley 693
Meeting of the Executive Committee of ICSU, London, June 15–17, 1964 ..... G. D. Garland 699

S193 G

(*Continued inside back cover*)

CONTENTS

(*Continued from back cover*)

UNION, SECTION, AND COMMITTEE ACTIVITIES—Continued

Report on the Symposium on Ultralow Frequency Electromagnetic Fields.....Charles P. Sonett 701
The Visiting Scientist Program in Geophysics 1963–1964..... 702
Committee on Audit.....A. G. McNish 702

SPECIAL ANNOUNCEMENTS

Forty-Sixth Annual Meeting..... 703
Southwestern Regional Meeting..... 704
Fifth Western National Meeting..... 704
AGU Announces a New Scientific Quarterly..... 704
National Meeting of the American Astronautical Society..... 704
IQSY Notes Available..... 704

IG BULLETINS

Bulletin 88..... 705
Ranger VII Photographic Mission to the Moon..... 705
Recent US Scientific Research in Antarctic..... 719
Bibliographic Notes..... 727
Bulletin 89..... 729
Results from the Aeronomy Satellite, Explorer XVII..... 729
Recent US Scientific Research in the Antarctic..... 737
Research in Geophysics..... 741
Bulletin 90..... 745
National Goals in Space, 1971–1985..... 745
Stratospheric Circulation Studies in the IQSY..... 752
Research aboard the *Eltanin* in the Weddell Sea and Scotia Arc..... 763
"IQSY Notes"..... 766
Bibliographic Notes..... 767

Index of Names..... 769
Index of Subjects..... 771
Supporting Members.....following page 774

OFFICERS OF THE UNION

GEORGE P. WOOLLARD, *President*
WILLIAM C. ACKERMANN, *Vice President*
A. NELSON SAYRE, *General Secretary*
THOMAS F. MALONE, *Secretary for International Participation*
WALDO E. SMITH, *Executive Secretary*

OFFICERS OF THE SECTIONS

Geodesy
CHARLES A. WHITTEN, *President*
URHO UOTILA, *Vice President*
BUFORD K. MEADE, *Secretary*

Seismology
JACK E. OLIVER, *President*
EUGENE HERRIN, *Vice President*
CARL KISSLINGER, *Secretary*

Meteorology
HENRY G. HOUGHTON, *President*
ROBERT G. FLEAGLE, *Vice President*
WOODROW C. JACOBS, *Secretary*

Geomagnetism and Aeronomy
E. H. VESTINE, *President*
FRANCIS S. JOHNSON, *Vice President*
KENDALL L. SVENDSEN, *Secretary*

Oceanography
WAYNE V. BURT, *President*
JOHN A. KNAUSS, *Vice President*
ARTHUR E. MAXWELL, *Secretary*

Volcanology, Geochemistry, and Petrology
JOHN VERHOOGEN, *President*
DONALD E. WHITE, *Vice President*
ROBERT O. FOURNIER, *Secretary*

Hydrology
DAVID K. TODD, *President*
MAX KOHLER, *Vice President*
RALPH N. WILSON, *Secretary*

Tectonophysics
DAVID T. GRIGGS, *President*
WILLIAM F. BRACE, *Vice President*
FRED A. DONATH, *Secretary*

Planetary Sciences
JAMES A. VAN ALLEN, *President*
HERBERT FRIEDMAN, *Vice President*
A. G. W. CAMERON, *Secretary*